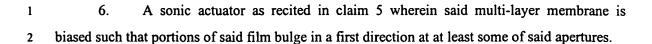
CLAIMS

1	1.	A sonic actuator comprising:
2	a multi-layer membrane including	
3		a non-metallic elastomeric dielectric polymer layer having a first
4		surface and a second surface;
5		a first compliant electrode layer contacting said first surface; and
6	•	a second compliant electrode layer contacting said second surface;
7		and
8	a supp	ort structure in contact with said sonic actuator film.
1	2.	A sonic actuator as recited in claim 1 wherein said non-metallic dielectric polymer
2	is selected fr	om the group consisting essentially of silicone, fluorosilicone, fluoroelastomer,
3	natural rubber	r, polybutadiene, nitrile rubber, isoprene, and ethylene propylene diene.
1	3.	A sonic actuator as recited in claim 1 wherein said compliant electrode layer is
2	made from th	e group consisting essentially of graphite, carbon, conductive polymers, and thin
3	metal films.	
1	4.	A sonic actuator as recited in claim 1 wherein said support structure is a grid
2	having a plura	ality of apertures.
1	5.	A sonic actuator as recited in claim 4 wherein said multi-layer membrane is
2	biased such th	nat portions of said film bulge at at least some of said apertures.



- 7. A sonic actuator as recited in claim 5 wherein said multi-layer membrane is biased such that portions of said film bulge in a first direction at some of said apertures and such that portions of said film bulge in a second direction at others of said apertures.
- 8. A sonic actuator as recited in claim 6 wherein said film is biased by a gaseous pressure that is greater than atmospheric pressure.
- 9. A sonic actuator as recited in claim 6 wherein said film is biased by a gaseous pressure that is less than atmospheric pressure.
- 1 10. A sonic actuator as recited in claim 6 wherein said film is biased by a soft foam 2 material.
- 1 11. A sonic actuator as recited in claim 10 wherein said soft foam material is a closedcell foam with an average cell diameter substantially less than a diameter of said apertures.
- 1 12. A sonic actuator as recited in claim 7 wherein said film is biased by a gaseous 2 pressure that is greater than atmospheric pressure where said film is bulging in a first direction, 3 and is biased by a gaseous pressure that is less than atmospheric pressure where said film is 4 bulging in a second direction.

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- 1 13. A sonic actuator as recited in claim 5 wherein said support structure is 2 substantially planar proximate to said apertures and wherein said bulging portion of said film 3 exhibit an out-of-plane deflection.
- 1 14. A sonic actuator as recited in claim 1 wherein said multi-layer membrane 2 comprises a sandwich structure having a plurality of layers of non-metallic elastomeric dielectric 3 polymers alternating with a plurality of layers of compliant electrodes.
- 1 15. A sonic actuator as recited in claim 1 further comprising a square root driver 2 coupled to said first compliant electrode and to said second compliant electrode.
- 1 16. A sonic actuator as recited in claim 15 wherein said square root driver includes a 2 summer adding a low power input signal to an offset voltage and a square root generator coupled 3 to an output of said summer.
- 1 17. A sonic actuator as recited in claim 16 further comprising a filter coupled to an output of said square root generator.
 - 18. A sonic actuator as recited in claim 17 further comprising an amplifier coupled to an output of said filter to provide a signal to drive said multi-layer membrane.